CLAIMS

1. A synchronization method for data demodulation in an OFDM radio receiver, comprising the steps of:

sampling and measuring an OFDM radio transmission to obtain a series of received-signal samples that represent a short preamble, a long preamble guard interval (GI), and a first long preamble, respectively;

computing an inner product of vectors comprised of samples x(n), x(n-1), ..., x(n-1-N) and x(n), x(n+1), ..., x(n+N) and computing the magnitude squared;

to exploit the periodicity of the long-preamble, coherent (and non-coherent) combining is performed as follows:

$$y(n)=\left\|\sum_{k=0}^{N-1}\{x(n-k)+x(n-k+64)\}\{x(n+k)+x(n+k+64)\}+\sum_{k=0}^{N-1}x(n+32-k)x(n+32+k)\right\|^2$$

assuming an index of the maximum of the result is the index of the start of the first long preamble;

subtracting a corresponding number of samples to find a first received-signal sample of said long preamble guard interval (GI); and

identifying said first sample of said long preamble GI to synchronize any data demodulation of subsequent parts of said OFDM radio transmission.

2. A synchronization method for data demodulation in an OFDM radio receiver, comprising the steps of:

computing includes constraining the reference signal so as to make it insensitive to timing misalignment;

computing includes constraining the reference signal so as to make it insensitive to frequency offset;

computing a reference signal that is insensitive to any other parametrizable impairment;

computing an inner product between the received signal and this constrained reference signal; and

assuming an index of the maximum of the result is the index of the start of the long preamble sequence.

3. A synchronization method for data demodulation in an OFDM radio receiver, comprising the steps of:

sampling and measuring an OFDM radio transmission to obtain a series of received-signal samples that represent a short preamble, a long preamble guard interval (GI), and a first long preamble, respectively;

massaging of the samples around x(n+32) can be performed so as to achieve a “coherent” copy of the samples around x(n) and x(n+64)

$$\vec{z}_B = [-x(n+32) \quad flipud(conj(x(n+32-1:-1:n+32-N)))]$$
$$\vec{z}_F = [-x(n+32) \quad flipud(conj(x(n+32+1:1:n+32+N)))]$$
$$y(n) = \left\| \sum_{k=0}^{N-1} \{x(n-k) + x(n-k+64) + \vec{z}_B(k)\}\{x(n+k) + x(n+k+64) + \vec{z}_F(n)\} \right\|^2$$

assuming an index of the maximum of the result is the index of the start of the first long preamble;

subtracting a corresponding number of samples to find a first received-signal sample of said long preamble guard interval (GI); and

identifying said first sample of said long preamble GI to synchronize any data demodulation of subsequent parts of said OFDM radio transmission.

4. A synchronization method for data demodulation in an OFDM radio receiver, comprising the steps of:

sampling and measuring an OFDM radio transmission to obtain a series of received-signal samples that represent a short preamble, a long preamble guard interval (GI), and a first long preamble, respectively;

the vector inner products (complex) result) of the previous and subsequent samples starting at x(n) and x(n+32) are added and then collect the sample at x(n+64+32)

$$y(n) = \left\| \sum_{k=0}^{N-1} x(n-k)x(n+k) + \sum_{k=0}^{N-1} x(n+32-k)x(n+32+k) \right\|^2$$

assuming an index of the maximum of the result is the index of the start of the first long preamble;

subtracting a corresponding number of samples to find a first received-signal sample of said long preamble guard interval (GI); and

identifying said first sample of said long preamble GI to synchronize any data demodulation of subsequent parts of said OFDM radio transmission.

5. A synchronization method for data demodulation in an OFDM radio receiver, comprising the steps of:

exploiting a specific structure in long-preamble, let x(0) be the first sample of the long-preamble, in the absence of signal impairments, the sequence of points, x(16), x(32), x(48), x(64), x(80), x(96) exhibits a unique relative phase transversal, in the absence of signal impairments, the absolute phase of this sequence is $\pi/4,0,-\pi/4,-\pi,\pi/4,0$. relative phases will be 0, $-\pi/4,-\pi/2,-5\pi/4,0,-\pi/4$;

wherein both the short- and long preambles, no other set of six samples separated by 16 samples exhibits this relative transversal.